

# SHEET SEPARATE-FEEDING APPARATUS

## BACKGROUND OF THE INVENTION

The present invention relates to a sheet separate-feeding  
5 apparatus used in a facsimile apparatus, a printer, and a copying  
machine, in which plural sheets such original documents and  
recording sheets are separated one by one to be fed.

Recently, a sheet separate-feeding apparatus in which  
plural sheets such original documents and recording sheets are  
10 separated one by one to be fed is used in a facsimile apparatus,  
a printer, and a copying machine. As a conventional sheet  
separate-feeding apparatus, for example, JP-A-9-240865 has been  
known.

Fig. 6 is a main portion sectional view showing one example  
15 of the conventional sheet separate-feeding apparatus. In the  
figure, reference numeral 51 is a conventional sheet  
separate-feeding apparatus, reference numeral 52 is a casing  
member of the sheet separate-feeding apparatus 51, reference  
numeral 53 is a sheet stacking portion located on the upper portion  
20 side of the casing member 53, reference numeral 54 is a sheet  
feeding surface formed on the lower portion side of the casing  
member 52, reference numeral 55 is a rotary shaft located at  
the lowest portion of the sheet stacking portion 53 orthogonally  
to a sheet feeding direction, reference numeral 56 is a separation  
25 roller attached to the rotary shaft 55, reference numeral 57

is a separation pad provided in pressure contact with the lower portion of the separation roller 56, reference character X is a sheet, and reference character Y is a separation point that is a contact portion between the separation roller 56 and the  
5 separation pad 57.

The thus constructed sheet separate-feeding apparatus operates as follows: Namely, the separation roller 56 attached to the rotary shaft 55 rotates with rotation of the rotary shaft 55, and feeds out the sheet X placed on the sheet stacking portion  
10 53 onto the sheet feeding surface 54. At this time, by the separation pad 57 set on the sheet feeding surface 54 in pressure-contact with the separation roller 56, the sheets X are separated one by one. Thus, by the sheet separate-feeding apparatus 51, the sheets X placed on the sheet stacking portion  
15 53 can be separated one by one to be fed onto the sheet feeding surface 54.

However, the above conventional sheet separate-feeding apparatus has the following problem.

In case that the plural sheets X are strongly pushed from  
20 the sheet stacking portion 53 toward the separation roller 56 when they are supplied onto the sheet stacking portion 53, the plural sheets X overlapped to each other are fed into the separation point Y that is the contact portion between the separation pad 57 and the separation roller 56, and nipped between  
25 the separation pad 57 and the separation roller 56. Therefore,

the plural sheets X are fed out from the separation roller 56 in an overlap state, so that a problem of double-feed of sheet X is caused.

#### SUMMARY OF THE INVENTION

5           The present invention has been made in order to solve the conventional problem, and its object is to provide a sheet separate-feeding apparatus which can prevent double-feed of sheet caused by the separation roller even in case that the plural sheets overlapped to each other are strongly pushed toward the  
10 separation roller from the sheet stacking portion.

          In order to solve the above problem, a sheet separate-feeding apparatus of the invention comprises a sheet stacking portion; a sheet feeding surface extending from the sheet stacking portion in a sheet feeding direction; a separation  
15 roller which is attached to a rotary shaft provided orthogonally to the sheet feeding direction, rotates with rotation of the rotary shaft, and feeds out the sheet placed on the sheet stacking portion onto the sheet feeding surface; and a separation pad which is arranged on the sheet feeding surface and brought into  
20 pressure-contact with the separation roller with the sheet nipped between the separation roller and it, wherein stopper levers which can come out and in freely are provided on both sides of a contact portion on the sheet feeding surface between the separation roller and the separation pad.

25           By this constitution, it is possible to provide the sheet

separate-feeding apparatus which can prevent double-feed of sheet caused by the separation roller even in case that the plural sheets overlapped to each other are strongly pushed toward the separation roller from the sheet stacking portion at the sheet  
5 supplying time.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a main portion perspective view of a facsimile apparatus including a sheet separate-feeding apparatus in a first embodiment of the invention;

10 Fig. 2A is a main portion perspective view of the sheet separate-feeding apparatus in the first embodiment of the invention;

Fig. 2B is a sectional view taken along a line A-A of Fig. 2A;

15 Fig. 3A is a main portion perspective view of the sheet separate-feeding apparatus in the first embodiment of the invention;

Fig. 3B is a sectional view taken along a line B-B of Fig. 3A;

20 Fig. 4A is a main portion sectional view showing a state where a cover of the sheet separate-feeding apparatus in the first embodiment of the invention is opened;

Fig. 4B is a main portion sectional view showing a state where the cover of the sheet separate-feeding apparatus in the  
25 first embodiment of the invention is closed;

Fig. 5 is a main portion perspective view showing a stopping member formed at an end portion of a movable sheet stacking portion; and

Fig. 6 is a main portion sectional view showing one example of a conventional sheet separate-feeding apparatus.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

(Embodiment 1)

Fig. 1 is a main portion perspective view of a facsimile apparatus including a sheet separate-feeding apparatus in a first embodiment of the invention, in which a sheet separate-feeding apparatus 1 is arranged at the rear upper portion of a facsimile apparatus 2. The sheet separate-feeding apparatus 1 includes a casing member 2, and a sheet stacking portion 3 extending on the upper portion of the casing member 2. At the lower portion of the sheet stacking portion 3, that is, on a sheet feeding direction side of the sheet stacking portion 3, a movable sheet stacking portion 4 is provided. The movable sheet stacking portion 4 is rotatably supported by the casing member 2 at its upper end portion. Further, a cover 5 is openably provided on the upper surface side of the movable sheet stacking portion 4.

Fig. 2A is a main portion perspective view of the sheet separate-feeding apparatus in the first embodiment of the invention. Fig. 2B is a sectional view taken along a line A-A shown in Fig. 2A. Fig. 3A is a main portion perspective view

of the sheet separate-feeding apparatus in the first embodiment of the invention. Fig. 3B is a sectional view taken along a line B-B shown in Fig. 3A. Fig. 5 is a main portion perspective view showing a stopping member formed at an end portion of a movable sheet stacking portion. In Figs. 2 and 3, the separation roller is omitted.

In Figs. 2A, 2B, 3A and 3B, reference numeral 4a is a lever operating mechanism which causes a stopper lever described later to come in and out in cooperation with closing and opening of the cover 5, reference numeral 4b is a stopping member provided on each side of the movable sheet stacking portion 4, reference numeral 4c is a stopping groove formed in the stopping member 4b, reference numeral 4d is a stopping slide inclined portion which is formed at the stopping member 4b and extends from the stopping groove 4c, reference numeral 4e is a lever pushing portion arranged at the lowest portion of the movable sheet stacking portion 4, and reference numeral 4f is a movable sheet stacking portion side wall standing on each side of the movable sheet stacking portion 4.

Reference numeral 5a is a cover stopping portion which is formed protrusively on each side of the cover 5 and on the opposite side of a cover rotating shaft of the cover 5 described later, and fits into the stopping groove 4c of the stopping member 4b in a state where the cover 5 is opened.

Reference numeral 6 is a stacking portion shaft supporting

portion provided for the casing member 2, reference numeral 6a is a stacking portion rotating shaft which is provided for the movable sheet stacking portion side wall 4f and supported by the stacking portion shaft supporting portion 6, and reference  
5 numeral 7 is a cover rotating shaft which supports openably the cover 5. The movable sheet stacking portion 4 has an elastic member such as a spring on its lower side and is energized to the cover 5 side.

Reference numeral 8 is a sheet feeding surface formed on  
10 the lower portion upper surface side of the casing member 2, and reference numeral 9 is a press member arranged in the center on the upper surface of the movable sheet stacking portion 4.

Reference numeral 10 is a separation member which is provided in the center on the upper surface side of the sheet  
15 feeding surface 8 and extends from the press member 9, and reference numeral 11 is a separation pad which is provided astride the press member 9 and the separation member 10 and brought into press-contact with a not-shown separation roller.

Reference numerals 12a and 12b are lever holes formed on  
20 the sheet feeding surface 8 and on both sides of the separation pad 11, and these lever holes 12a and 12b are provided in positions where the separation member 10 is put between them. Lever members (described later in detail) are provided for these lever holes 12a and 12b so that they can come in and out. Reference numerals  
25 13a and 13b are stopper levers each of which is a part of the

lever member protruding from the lever hole 12a, 12b.

In Fig. 2B, a lever member 14 is formed nearly in the shape of L. The stopper lever 13a is formed at one end of the lever member 14, and a pushing side end portion 14b is formed at the other end thereof. Reference numeral 13c is a catch portion formed at the stopper lever 13a. The lever member 14 is supported rotatably by a lever rotating shaft 14a provided for a bent portion thereof. Reference numeral 14a is a lever rotating shaft which supports the lever member 14 rotatably. Reference numeral 14b is a pushing side end portion which is formed at the other end of the lever member 14 and pushed by the lever pushing portion 4e of the movable sheet stacking portion 4. Further, the lever member 14 arranged in the other lever hole 12b has also the same constitution, that is, it is supported by the lever rotating shaft rotatably and a catch portion is formed at the stopper lever 13b that can come in and out.

The lever operating mechanism 4a which drives the lever member 14 in cooperation with opening and closing of the cover 5 comprises the cover stopping portion 5a provided for the cover 5, and the stopping member 4b provided for the movable sheet stacking portion 4. The lever operating mechanism 4a will be described below.

The cover stopping member 5a is provided at each end of the plate-like cover 5 and protrudes through the cover rotating shaft 7 to the opposite side. On both ends of the movable sheet



stacking portion 4, as shown in Fig. 5, the stopping members 4b are formed opposed to the cover stopping portions 5a. The stopping member 4b includes the stopping groove 4c and the stopping slide inclined portion 4d formed on the lower portion side of the stopping groove 4c.

As described before, the movable sheet stacking portion 4 is energized to the cover 5 side by the spring. When the cover 5 rotates from its closed position in its opened direction, the cover stopping portion 5a touches and pushes the stopping slide inclined portion 4d while it is sliding on this stopping slide inclined portion 4d. Then, the movable sheet stacking portion 4 is pushed up against the energizing force of the spring. In result, the cover stopping portion 5a fits into the stopping groove 4c, and the cover 5 is settled in the opened state (refer to Figs. 2A and 2B). Namely, the cover 5 keeps the opened state and the movable sheet stacking portion 4 is in the pushed down state.

When the movable sheet stacking portion 4 is pushed down and the pushing side end portion 14b is pushed upon reception of the force from the lever pushing portion 4e, the lever member 14 rotates, and the stopper lever 13a (13b) protrudes from the sheet feeding surface 8 (Fig. 3B → Fig. 2B). Further, when pushing by the lever pushing portion 4e is released, the stopper lever 13a rotates by its own weight in the direction where it comes in the sheet feeding surface 8.

The stopper levers 13a and 13b are arranged at least on this side in the feeding direction in the vicinity of the contact portion between the separation roller and the separation pad 11. At this stopper lever 13a, 13b, the catch portion 13c protruding to the contact side with the sheet is formed. When the cover 5 opens, the movable sheet stacking portion 4 is pushed down, and the stopper levers 13a and 13b protrude from the sheet feeding surface 8 (Fig. 2B). Under the state where the stopper levers 13a and 13b protrude, the sheet is caught surely by the stopper levers 13a and 13b because of this catch portion. Therefore, it is possible to surely prevent the sheet from being inserted between the separation roller and the separation pad 11 over the separation point.

The sheet separate-feeding apparatus 1 includes a separation roller that is a pick-up roller which feeds out the sheet on the sheet stacking portion 3 and the movable sheet stacking portion 4. Though the separation roller is not shown, it is supported by a rotary shaft and comes into contact with the upper portion of the separation pad 11.

In Fig. 2A, the separation pad 11 is formed of a thin plate-like cork material and has flexibility. At the lower portion of the separation pad 11, there are arranged the press member 9 for pressing the separation pad 11 against the separation roller, and the separation member 10 which separates, from the plural sheets overlapped to each other that the separation roller

is about to feed out, only one sheet coming into contact with the separation roller and causes the separation roller to feed out its sheet. Further, at the lower portions of the press member 9 and the separation member 10, springs for energizing the press member 9 and the separation member 10 to the separation roller side are arranged.

Regarding the thus constructed sheet separate-feeding apparatus in the first embodiment of the invention, its operation will be described below with reference to the drawings.

Fig. 4A is a main portion sectional view showing a state where the cover of the sheet separate-feeding apparatus in the first embodiment of the invention is opened, and Fig. 4B is a main portion sectional view showing a state where the cover of the sheet separate-feeding apparatus in the first embodiment of the invention is closed. In Fig. 4, reference numeral 15 is a rotary shaft, reference 16 is a separation roller supported by the rotary shaft 15 rotatably, reference character X is a sheet, and reference character Y is a separation point. Parts similar to those described with reference to Fig. 2 or 3 are denoted by the same reference numerals, and their description is omitted.

As shown in Fig. 4A, when the cover 5 is rotated about the cover rotating shaft 7 in a direction C to be opened, the cover stopping portion 5a moves along the stopping slide inclined portion 4d to the upside and fits in the stopping groove 4b.

At this time, the movable sheet stacking portion 4 rotates about the stacking portion rotating shaft 6a, and the lever pushing portion 4e formed at the lower end portion of the movable sheet stacking portion 4 moves in a direction D. By this lever pushing  
5 portion 4e, the pushing side end portion 14b of the lever member 14 is pushed into, the lever member 14 rotates about the lever rotating shaft 14a in a direction E, and the stopper lever 13a protrudes from the sheet feeding surface 8.

Hereby, when the sheets X are supplied to the sheet stacking  
10 portion, even in case that the plural sheets X overlapped to each other are strongly pushed toward the separation roller 16 from the upstream side in the feeding direction, the sheets X are caught by the stopper levers 13a. Therefore, it is possible to prevent the sheets X from being inserted between the separation  
15 roller 16 and the separation pad 11 over the separation point Y.

Next, as shown in Fig. 4B, when the cover 5 is rotated about the cover rotating shaft 7 in a direction F to be closed, the cover stopping portion 5a moves from the stopping groove  
20 4b along the stopping slide inclined portion 4d to the downside. At this time, the movable sheet stacking portion 4 is energized by a not-shown spring and rotates about the stacking portion rotating shaft 6a, and the lever pushing portion 4e formed at the lower end portion of the movable sheet stacking portion 4  
25 moves in a direction G. Hereby, pushing by the lever pushing

portion 4e applied to the pushing side end portion 14b of the lever member 14 is released, the lever member 14 rotates about the lever rotating shaft 14a in a direction H by its own weight, and the stopper lever 13a comes in.

5           After the cover 5 was closed, the plural sheets X overlapped to each other which have been supplied onto the sheet stacking portion are not strongly pushed toward the separation roller 16 from the upstream side in the feeding direction. Therefore, the leading ends of the sheets X are arranged in the suitable  
10 point on this side of the separation point Y. Hereby, it is possible to surely separate, from the plural sheets X overlapped to each other that the separation roller 16 is about to feed out, only one sheet coming into contact with the separation roller 16.

15           Here, in the vicinity of the separation point Y, by rotation of the separation roller 16, feeding force F1 is produced in the top sheet coming into contact with the separation roller 16. Simultaneously, frictional force F2 with the top sheet is produced in the second sheet from the top, and the second sheet  
20 is fed in the same direction by the frictional force F2. However, by pressing of the separation pad 11, frictional force F3 is produced between the sheets and the separation pad 11, and the sheets receive the frictional force F3. Accordingly, in the vicinity of the separation point Y, the following relation is  
25 satisfied: (feeding force F1) > (frictional force F3) >

(frictional force  $F_2$ ). Hereby, only the top sheet coming into contact with the separation roller 16 can be fed.

Since the sheet separate-feeding apparatus in the first embodiment of the invention is thus constructed, even in case  
5 that the plural sheets X overlapped to each other are strongly pushed toward the separation roller 16 from the upstream side in the feeding direction at the sheet X supplying time, the double-feed of sheet X can be prevented and the plural sheets X can be surely separated one by one.

10 As described above, according to the sheet separate-feeding apparatus of the invention, the following advantageous effects can be obtained.

Namely,

(1) Even in case that the plural sheets overlapped to each  
15 other are strongly pushed toward the separation roller from the sheet stacking portion at the sheet supplying time, since the sheets are caught by the protruding stopper lever, it is possible to prevent the sheets from being inserted between the separation roller and the separation pad over the separation point.  
20 Therefore, it is possible to provide the sheet separate-feeding apparatus which can surely separate, from the plural sheets overlapped to each other that the separation roller is about to feed out, only one sheet coming into contact with the separation roller, and can prevent the double-feed of sheet caused by the  
25 separation roller.

(2) When the sheet is fed onto the sheet feeding surface side by the separation roller, since the stopper lever is caused to come in, in a state where the leading ends of the sheets are arranged in the suitable position on this side of the separation point, the sheets are fed to the separation roller. Therefore,  
5 it is possible to provide the sheet separate-feeding apparatus in which only one sheet coming into contact with the separation roller can be surely separated from the other sheets.

Further, since the stopper lever is arranged on this side  
10 in the feeding direction in the vicinity of the contact portion between the separation roller and the separation pad 11, it is possible to provide the sheet separate-feeding apparatus which can surely prevent the sheets from being inserted between the separation roller and the separation pad over the separation  
15 point.

Further, in case that the openable cover is provided for the sheet insertion inlet of the sheet stacking portion, and the lever operating mechanism which causes the stopper lever to come in and out in cooperation with opening and closing of  
20 this cover is provided, the following effects can be obtained:

(1) Since the stopper lever can be protruded from the sheet feeding surface through the lever operating mechanism by opening the cover, when the cover is opened to supply the sheets onto the sheet stacking portion, even in case that the plural sheets  
25 overlapped to each other are strongly pushed toward the

separation roller from the sheet stacking portion, the sheets are caught by the protruding stopper levers. Therefore, it is possible to provide the sheet separate-feeding apparatus which can surely prevent the sheets from being inserted between the separation roller and the separation pad over the separation point.

(2) By closing the cover, the stopper lever can be caused to come in the sheet feeding surface through the lever operating mechanism. Therefore, after the cover was closed, in a state where the leading ends of the sheets are arranged in the suitable position on this side of the separation point, the sheets are fed to the separation roller, so that it is possible to provide the sheet separate-feeding apparatus in which only one sheet coming into contact with the separation roller can be surely separated from the other sheets.

Further, the lever operating mechanism includes the movable sheet stacking portion which extends from the sheet stacking portion in the sheet feeding direction, is supported on the sheet stacking portion side, and is arranged tiltably; the lever pushing portion which is provide for this movable sheet stacking portion, and pushes the pushing side end by the inclination of the movable sheet stacking portion in the direction where the stopper lever is protruded; and the stopping members provided on the both sides of the movable sheet stacking portion, wherein the stopping members provided on the both sides



of the movable sheet stacking portion are pressed at the both sides of the cover in cooperation with opening and closing of the cover thereby to tilt the movable sheet stacking portion. Hereby, the following effects can be obtained:

5           (1) When the cover is rotated to be opened, the cover stopping portion presses the stooping member, the movable sheet stacking portion tilts to the downside, the lever pushing portion formed at the lower end of the movable sheet stacking portion moves to the pushing side end portion side of the lever member, 10 the pushing side end portion is pushed by the lever pushing portion, the lever member rotates, and the stopper lever protrudes from the sheet feeding surface. Hereby, when the sheets are supplied onto the sheet stacking portion, even in case that the plural sheets overlapped to each other are strongly pushed toward the 15 separation roller from the upstream side in the feeding direction, the sheets are caught by the stopper levers. Therefore, it is possible to provide the sheet separate-feeding apparatus which can prevent the sheets from being inserted between the separation roller and the separation pad over the separation point.

20           (2) When the cover is closed, pressing of the stopping member by the cover stopping portion is released, the movable sheet stacking portion is energized by the spring and tilts to the upside, the lever pushing portion formed at the lower end portion of the movable sheet stacking portion moves in the 25 direction where it separates from the pushing side end portion,

pushing by the lever pushing portion applied to the pushing side  
end portion of the lever member is released, the lever member  
rotates by its own weight, and the stopper lever comes in. Hereby,  
it is possible to provide the sheet separate-feeding apparatus  
5 which can surely separate, from the plural sheets overlapped  
to each other that the separation roller is about to feed out,  
only one sheet coming into contact with the separation roller.

Further, since the sheets are surely caught by the stopper  
lever due to the catching portion of the stopper lever formed  
10 protrusively to the contact side with the sheet, it is possible  
to provide the sheet separate-feeding apparatus which can surely  
prevent the sheets from being inserted between the separation  
roller and the separation pad over the separation point.